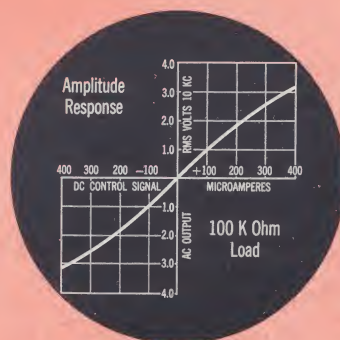
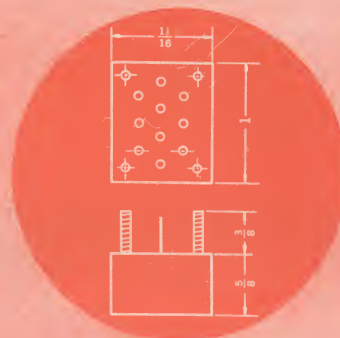


# "MAG MOD"<sup>®</sup> miniaturized

## MAGNETIC MODULATORS

Rugged, dependable "MAG MOD" has proven to be the most reliable module circuit block in aircraft and space vehicle flight control systems developed to date. Highly shock-proof, its repeatability, universal energy and impedance ranges — plus superior performance — have resulted in wide application in many military and commercial products where reliability is a prime factor. All "MAG MODS" conform to MIL-T-27A and MIL-E-5400 Specifications.



THERE IS NO SUBSTITUTE FOR RELIABILITY



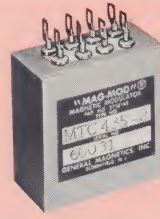
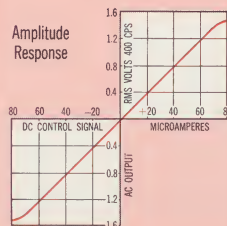
# "MAG MOD"® *miniaturized* MAGNETIC

## ELECTRICAL AND MECHANICAL ADVANTAGES—

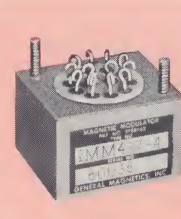
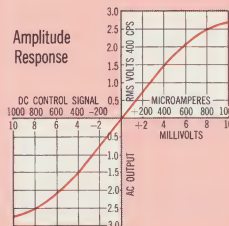
- Absolute reliability • Unlimited life
- Repeatable data over years of continuous unattended operation
- High shock and vibration proof
- Low milliwatt power consumption
- Bandwidth may be extended to the kilocycle range
- No vacuum tubes, semiconductors or moving parts to limit life
- Four quadrant operation
- Extreme stability with negligible change of product accuracy over a wide temperature range
- Simple, lightweight, rugged



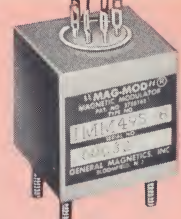
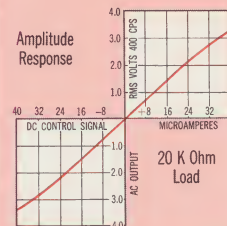
Miniaturized Magnetic Modulator Type IMM-436-3



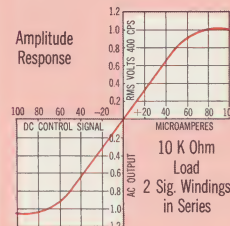
Miniaturized Magnetic Modulator Type MTC-435-2



Miniaturized Magnetic Modulator Type IMM-487-4

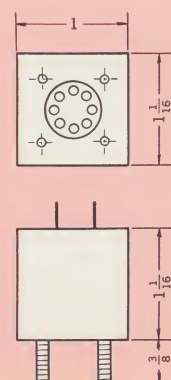
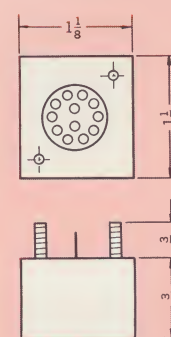
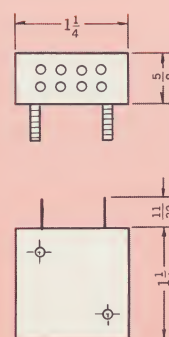
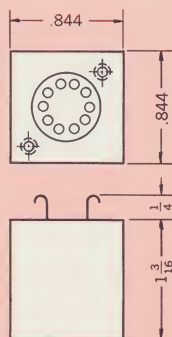


Miniaturized Magnetic Modulator Type IMM-495-8



| TYPE NUMBER                                                                                                                                       | IMM-436-3                                                 | MTC-435-2<br>(THERMOCOUPLE CONVERTER)                | IMM-487-4                                                                        | IMM-495-8                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Reference Carrier Voltage and Frequency                                                                                                           | 2.5 V @ 400 cps                                           | 6 V @ 400 cps                                        | 115 V @ 400 cps                                                                  | 115 V @ 400 cps                                                           |
| Input Control Signal Range                                                                                                                        | 2 Windings<br>0 to $\pm 100 \mu\text{A}$ DC each          | 0 to $\pm 10 \text{ mv}$ DC                          | 2 Windings<br>0 to $\pm 40 \mu\text{A}$ DC each                                  | 2 Windings<br>0 to $\pm 100 \mu\text{A}$ DC each                          |
| DC Resistance of Input DC Signal Winding                                                                                                          | 2 Windings<br>1000 ohms each                              | 10 ohms                                              | Inp. Wdg. 1, 6170 ohms<br>Inp. Wdg. 2, 7400 ohms                                 | Inp. Wdg. 1, 550 ohms<br>Inp. Wdg. 2, 600 ohms                            |
| AM Phase Reversing AC Output Range                                                                                                                | 0 to 1.5 V RMS<br>@ 400 cps                               | 0 to 2.7 V RMS<br>@ 400 cps                          | 0 to 3.0 V RMS<br>@ 400 cps                                                      | 0 to 1.0 V RMS<br>@ 400 cps                                               |
| Differential Gain<br>RMS Volts AC Output/ $\mu\text{A}$ DC Signal Input                                                                           | 25 mv/ $\mu\text{A}$                                      | 350 mv/ $\mu\text{A}$                                | 100 mv/ $\mu\text{A}$ (Each Wdg.)<br>200 mv/ $\mu\text{A}$ (Both in Series)      | 15 mv/ $\mu\text{A}$ (Each Wdg.)<br>30 mv/ $\mu\text{A}$ (Both in Series) |
| AC Output Null (Noise Level) mv RMS                                                                                                               | 15 mv RMS Maximum                                         | 25 mv RMS Maximum                                    | 20 mv RMS Maximum                                                                | 5 mv RMS Maximum                                                          |
| Output Impedance                                                                                                                                  | 7 K ohms                                                  | 10 K ohms                                            | 30 K ohms                                                                        | 1600 ohms                                                                 |
| Reference Carrier Winding Input Impedance                                                                                                         | 5 K ohms                                                  | 5 K ohms                                             | 20 K ohms                                                                        | 25 K ohms                                                                 |
| External Load for Zero Phase Shift of Output versus Reference                                                                                     | 25 ohms                                                   | 50 K ohms                                            | 20 K ohms                                                                        | 10 K ohms                                                                 |
| Null or Zero Drift over Temperature Range of $-55^\circ\text{C}$ to $+125^\circ\text{C}$ in terms of DC Input Signal Reference to Input Terminals | $\pm 0.5 \mu\text{A}$ DC Maximum                          | $\pm 0.05 \text{ mv}$ DC Maximum                     | $\pm 0.2 \mu\text{A}$ DC (One Wdg.)<br>$\pm 0.1 \mu\text{A}$ DC (Both in Series) | $\pm 0.25 \mu\text{A}$ DC (Both Wdgs. in Series)                          |
| Hysteresis in Percent of Maximum Input DC Signal                                                                                                  | Less than 0.5%                                            | 0.25% Maximum                                        | 0.25% Maximum                                                                    | 0.25% Maximum                                                             |
| Percent Harmonic Distortion in Output Product Wave                                                                                                | 20% Maximum                                               | 20% Maximum                                          | 20% Maximum                                                                      | 25% Maximum                                                               |
| Frequency Response                                                                                                                                | —                                                         | —                                                    | 12 cps for Signal Source Impedance of 15 K ohms                                  | 20 cps for Signal Source Impedance of 10 K ohms                           |
| Overall Dimensions (in Inches)                                                                                                                    | $2\frac{7}{32} \times 2\frac{7}{32} \times 1\frac{1}{16}$ | $\frac{5}{8} \times \frac{7}{8} \times 1\frac{1}{4}$ | $1\frac{1}{8} \times 1\frac{1}{4} \times \frac{3}{4}$                            | $\frac{3}{4} \times 1 \times 1$                                           |
| Type of Mounting                                                                                                                                  | Two 4-40 Inserts                                          | Two 4-40 Studs                                       | Two 4-40 Inserts                                                                 | Two 4-40 Studs                                                            |
| Approximate Weight (in Ounces)                                                                                                                    | 1.2                                                       | 1.5                                                  | 1.25                                                                             | 1.0                                                                       |

"MAG MOD" Magnetic Modulators may be mounted directly on printed circuit cards. They offer infinite design possibilities and impedance levels. "MAG MODS" are adaptable for algebraic addition, subtraction, multiplying, dividing, raising to a power and vector summing.

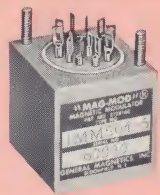




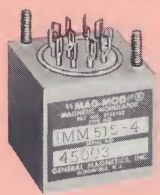
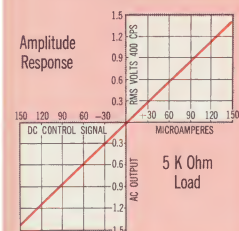
# MODULATORS

CONFORM TO MIL-T-27A AND MIL-E-5400 SPECIFICATIONS

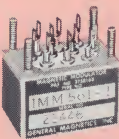
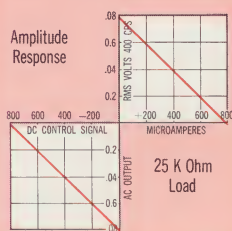
Products shown approximately one-half actual size



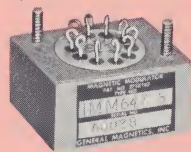
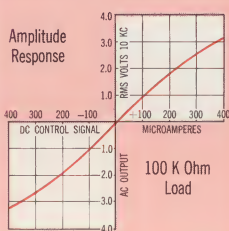
**Miniaturized Magnetic Modulator Type IMM-504-5**



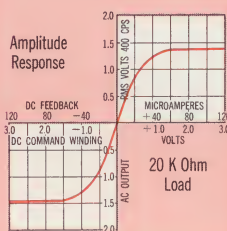
**Miniaturized Magnetic Modulator Type IMM-515-4**



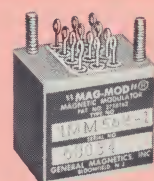
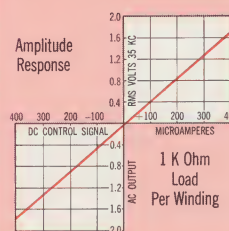
**Miniaturized Magnetic Modulator Type IMM-561-1**



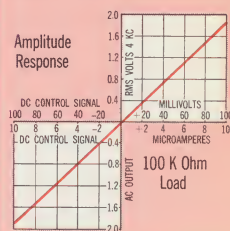
**Miniaturized Magnetic Modulator Type IMM-647-5**



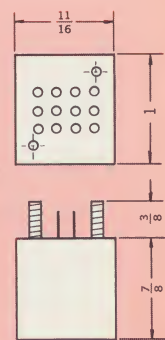
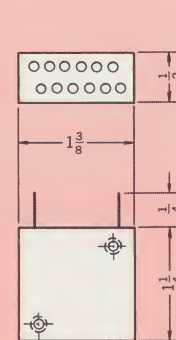
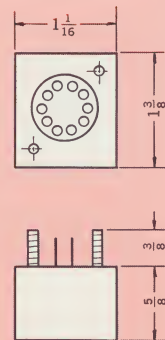
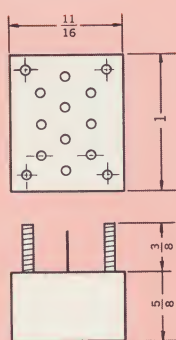
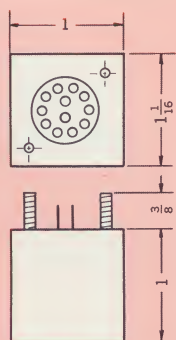
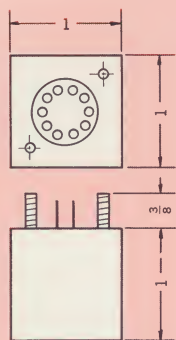
**Miniaturized Magnetic Modulator Type IMM-556-5**



**Miniaturized Magnetic Modulator Type IMM-562-1**



| IMM-504-5                                          | IMM-515-4<br>(LINEAR MULTIPLIER MOD)                              | IMM-561-1                                      | IMM-647-5                                                       | IMM-556-5                                              | IMM-562-1                                        |
|----------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------|
| 115 V @ 400 cps                                    | 0 to 1.0 V @ 400 cps                                              | 1.0 V @ 10 KC                                  | 115 V @ 400 cps                                                 | 6 to 10 V @ 35 KC                                      | 2.5 V @ 4 KC                                     |
| 0 to $\pm 150 \mu\text{A}$ DC                      | 2 Windings<br>0 to $\pm 800 \mu\text{A}$ DC each                  | 0 to $\pm 400 \mu\text{A}$ DC                  | 0 to $\pm 10 \mu\text{A}$ DC or<br>0 to $\pm 250 \text{ mV}$ DC | 0 to $\pm 400 \mu\text{A}$ DC                          | 0 to $\pm 100 \mu\text{A}$ DC                    |
| 1000 ohms                                          | 2 Windings<br>1250 ohms each                                      | 200 ohms                                       | Inp. Wdg. 1, 25 K ohms<br>Inp. Wdg. 2, 13 K ohms                | 5 K ohms                                               | Signal Wdg. 1300 ohms<br>Feedback Wdg. 160 ohms  |
| 0 to 1.5 V RMS<br>@ 400 cps                        | Max. Output for Zero Sig.<br>0 to $\pm 8 \text{ V RMS}$ @ 400 cps | 0 to 3.0 V RMS<br>@ 10 KC                      | 0 to 0.5 V RMS<br>@ 400 cps                                     | 2 Out. Wdgs. each<br>0 to 1.8 V RMS @ 35 KC            | 0 to 6.0 V RMS<br>@ 4 KC                         |
| 10 mv/ $\mu\text{A}$                               | 3.0 mv/ $\mu\text{A}$                                             | 10 mv/ $\mu\text{A}$                           | 50 mv/ $\mu\text{A}$                                            | 4.2 mv/ $\mu\text{A}$                                  | 200 mv/ $\mu\text{A}$                            |
| 10 mv RMS Maximum                                  | 5 mv RMS Maximum                                                  | 10 mv RMS Maximum                              | 5 mv RMS Maximum                                                | 20 mv RMS Maximum                                      | 30 mv RMS Maximum                                |
| 1000 ohms                                          | 2600 ohms                                                         | 40 K ohms                                      | 13 K ohms                                                       | 900 ohms (Each Wdg.)                                   | 70 K ohms                                        |
| 25 K ohms                                          | 5 K ohms                                                          | 10 K ohms                                      | 58 K ohms                                                       | 10 K ohms                                              | 5 K ohms                                         |
| 5 K ohms                                           | 25 K ohms                                                         | 100 K ohms                                     | 20 K ohms                                                       | 1000 ohms (Each Winding)                               | 100 K ohms                                       |
| $\pm 0.5 \mu\text{A}$ DC                           | $\pm 1.0 \mu\text{A}$ DC                                          | $\pm 1.0 \mu\text{A}$ DC                       | $\pm 0.2 \mu\text{A}$ DC                                        | $\pm 1.5 \mu\text{A}$ DC                               | $\pm 0.5 \mu\text{A}$ DC                         |
| 0.25% Maximum                                      | 0.5% Maximum                                                      | 0.25% Maximum                                  | 0.1% Maximum                                                    | 0.5% Maximum                                           | 0.5% Maximum                                     |
| 30% Maximum                                        | 5% Maximum                                                        | 10% Maximum                                    | 20% Maximum                                                     | 5% Maximum                                             | 10% Maximum                                      |
| 20 cps for Signal Source<br>Impedance of 10 K ohms | 20 cps for Sig. Source<br>Impedance of 20 K ohms                  | 2 KC for Sig. Source<br>Impedance of 10 K ohms | 30 cps for Sig. Source<br>Impedance of 100 K ohms               | 600 cps for Sig. Source<br>Impedance of 1000 ohms      | 70 cps for Sig. Source<br>Impedance of 10 K ohms |
| 1 x 1 x 1                                          | 1 x 1 x 1                                                         | $\frac{5}{8} \times \frac{1}{16} \times 1$     | $1\frac{1}{16} \times 1\frac{3}{8} \times \frac{5}{8}$          | $\frac{7}{16} \times 1\frac{3}{8} \times 1\frac{1}{4}$ | $1 \times \frac{1}{16} \times \frac{7}{8}$       |
| Two 4-40 Studs or Inserts                          | Two 4-40 Studs                                                    | Two 2-56 Studs                                 | Two 4-40 Studs                                                  | Two 4-40 Studs or Inserts                              | Two 4-40 Studs or Inserts                        |
| 1.1                                                | 1.1                                                               | 0.6                                            | 1.0                                                             | 1.0                                                    | 0.75                                             |

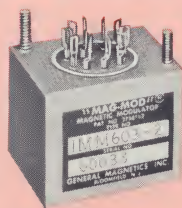




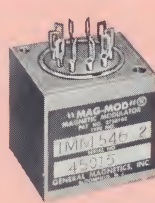
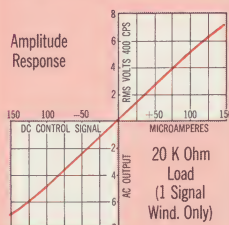
# "MAG MOD" *miniaturized* MAGNETIC MODULATORS

## Functions of the "MAG MOD" —

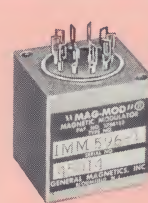
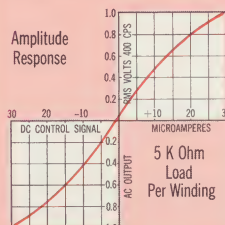
This miniaturized ultra-reliable, balanced modulator circuit is a DC to AC Converter which presents a linear relationship between input control signal and output AC. It is a device whose output is a function of one variable. A variable amplitude bipolar DC or low frequency AC applied to the input produces a corresponding variable amplitude phase reversing AC output of 0° to 180° with respect to the reference carrier depending on the magnitude and polarity of the input signal. The magnetic modulator may easily be designed to operate over any energy or input/output impedance level. Any number of inputs and/or outputs may be provided depending upon analog operation requirements.



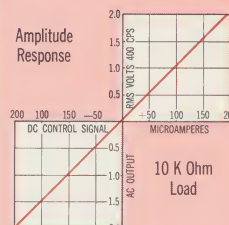
**Miniaturized  
Magnetic Modulator  
Type IMM-603-2**



**Miniaturized  
Magnetic Modulator  
Type IMM-546-2**



**Miniaturized  
Magnetic Modulator  
Type IMM-596-1**



ALL "MAG MODS"  
CONFORM TO  
MIL-T-27A AND  
MIL-E-5400  
SPECIFICATIONS

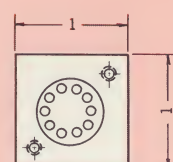
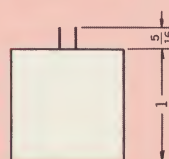
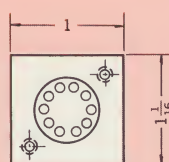
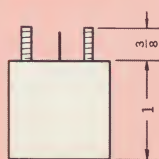
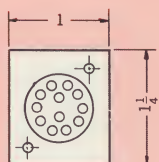
PRODUCTS  
SHOWN  
APPROXIMATELY  
ONE-HALF  
ACTUAL SIZE

| TYPE NUMBER                                                                                                                                             | IMM-603-2                                                                     | IMM-546-2                                     | IMM-596-1                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------|
| Reference Carrier Voltage and Frequency                                                                                                                 | 26 V @ 400 cps                                                                | 26 V @ 400 cps                                | 4 V @ 400 cps                 |
| Input Control Signal Range                                                                                                                              | 2 Windings<br>0 to $\pm 150 \mu\text{A}$ DC each                              | 0 to $\pm 30 \mu\text{A}$ DC                  | 0 to $\pm 200 \mu\text{A}$ DC |
| DC Resistance of<br>Input DC Signal Winding                                                                                                             | Sig. Wdg. 1, 7800 ohms<br>Sig. Wdg. 2, 8400 ohms                              | 25 K ohms                                     | 2 K ohms                      |
| AM Phase Reversing AC Output Range                                                                                                                      | 0 to 7.0 V RMS<br>@ 400 cps                                                   | 2 Out. Wdgs. each<br>0 to 1.0 V RMS @ 400 cps | 0 to 2.0 V RMS<br>@ 400 cps   |
| Differential Gain<br>RMS Volts AC Output/ $\mu\text{A}$ DC Signal Input                                                                                 | 50 mv/ $\mu\text{A}$ (Each Winding)<br>100 mv/ $\mu\text{A}$ (Both in Series) | 42 mv/ $\mu\text{A}$<br>Each Winding          | 10 mv/ $\mu\text{A}$          |
| AC Output Null (Noise Level) mv RMS                                                                                                                     | 35 mv RMS Maximum                                                             | 10 mv RMS Maximum                             | 20 mv RMS Maximum             |
| Output Impedance                                                                                                                                        | 2800 ohms                                                                     | 500 to 1000 ohms                              | 5.5 K ohms                    |
| Reference Carrier Winding Input Impedance                                                                                                               | 10 K ohms                                                                     | 10 K ohms                                     | 1.5 K ohms                    |
| External Load for Zero Phase<br>Shift of Output versus Reference                                                                                        | 10 to 100 K ohms                                                              | 5 K ohms (Each Winding)                       | 10 K ohms                     |
| Null or Zero Drift over Temperature<br>Range of $-55^\circ\text{C}$ to $+125^\circ\text{C}$ in terms of DC<br>Input Signal Reference to Input Terminals | $\pm 0.5 \mu\text{A}$ DC                                                      | $\pm 0.15 \mu\text{A}$ DC                     | $\pm 0.5 \mu\text{A}$ DC      |
| Hysteresis in Percent of Maximum<br>Input DC Signal                                                                                                     | 0.5% Maximum                                                                  | $\pm 0.15\%$ Maximum                          | 0.5% Maximum                  |
| Percent Harmonic Distortion in Output Product Wave                                                                                                      | 10% Maximum                                                                   | 30% Maximum                                   | 15% Maximum                   |
| Frequency Response                                                                                                                                      | —                                                                             | —                                             | —                             |
| Overall Dimensions (in Inches)                                                                                                                          | 1 x 1 1/4 x 1                                                                 | 1 1/8 x 1 x 1                                 | 1 x 1 x 1                     |
| Type of Mounting                                                                                                                                        | Two 4-40 Studs or Inserts                                                     | Two 4-40 Inserts                              | Two 4-40 Studs                |
| Approximate Weight (in Ounces)                                                                                                                          | 1.1                                                                           | 1.0                                           | 1.1                           |

Request bulletins on other "Mag Mod" Magnetic Amplifier components. "Mag Mods" are products of —

**GENERAL  
MAGNETICS • INC**

135 BLOOMFIELD AVENUE  
BLOOMFIELD, NEW JERSEY

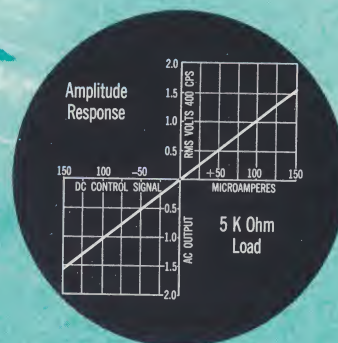


Litho in U.S.A.





**"MAG MOD"**  
standard



## MAGNETIC MODULATORS

These high-reliability components offer solutions to problems involved in a wide range of data systems where analog circuit operations are encountered. They are ideal for incorporation in miniature circuit assemblies and printed circuit card configurations. "MAG MODS" provide extreme stability over a wide temperature range, faster response time, infinite service life. Mechanical mounting may be modified to conform to packaging requirements.



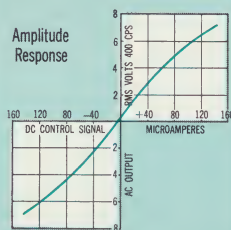
THERE IS NO SUBSTITUTE FOR RELIABILITY



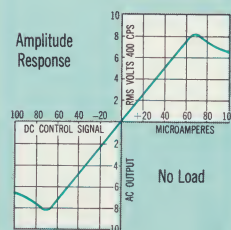
- Absolute reliability • Unlimited life
- Repeatable data over years of continuous unattended operation
- High shock and vibration proof
- Low milliwatt power consumption
- Bandwidth may be extended to the kilocycle range
- No vacuum tubes, semiconductors or moving parts to limit life
- Four quadrant operation
- Extreme stability with negligible change of product accuracy over a wide temperature range
- Simple, lightweight, rugged
- May be mounted directly on printed circuit cards
- Infinite design possibilities and impedance levels
- Adaptable for algebraic addition, subtraction, multiplying, dividing, raising to a power and vector summing



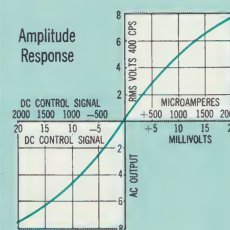
Standard Magnetic Modulator  
Type IMM-311-1



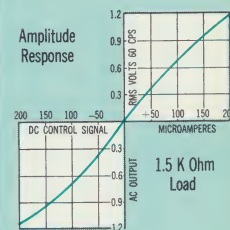
Standard Magnetic Modulator  
Type IMM-336-1



Standard Magnetic Modulator  
Type MTC-336-10



Standard Magnetic Modulator  
Type IMM-378-1

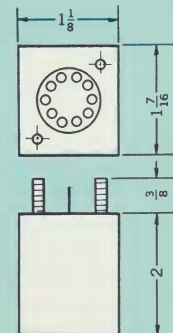
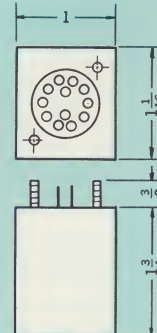
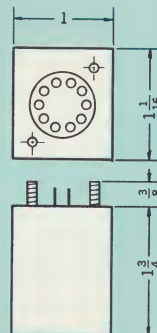
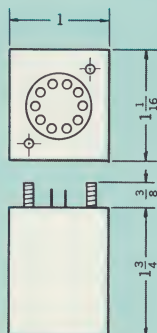


| TYPE NUMBER                                                                                                                                     | IMM-311-1                                   | IMM-336-1                                   | MTC-336-10                                  | IMM-378-1                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|
| Reference Carrier Voltage and Frequency                                                                                                         | 5 V @ 400 cps                               | 115 V @ 400 cps                             | 6 V @ 400 cps                               | 115 V @ 60 cps                              |
| Input Control Signal Range                                                                                                                      | 0 to $\pm 120 \mu\text{A}$ DC               | 0 to $\pm 100 \mu\text{A}$ DC               | 0 to $\pm 20 \text{ mV}$ DC                 | 0 to $\pm 200 \mu\text{A}$ DC               |
| DC Resistance of Input DC Signal Winding                                                                                                        | 1000 ohms                                   | 10 K ohms                                   | 10 ohms                                     | 1250 ohms                                   |
| AM Phase Reversing AC Output Range                                                                                                              | 0 to 7.0 V RMS @ 400 cps                    | 0 to 8.0 V RMS @ 400 cps                    | 0 to 8.0 V RMS @ 400 cps                    | 0 to 1.2 V RMS @ 60 cps                     |
| Differential Gain RMS Volts AC Output/ $\mu\text{A}$ DC Signal Input                                                                            | 55 $\text{mV}/\mu\text{A}$ (No Load)        | 130 $\text{mV}/\mu\text{A}$ (No Load)       | 500 $\text{mV}/\mu\text{A}$                 | 7 $\text{mV}/\mu\text{A}$                   |
| AC Output Null (Noise Level) $\text{mV}$ RMS                                                                                                    | 20 $\text{mV}$ RMS                          | 25 $\text{mV}$ RMS Maximum                  | 25 $\text{mV}$ RMS Maximum                  | 10 $\text{mV}$ RMS Maximum                  |
| Output Impedance                                                                                                                                | Approx. 20 K ohms                           | Approx. 25 K ohms                           | Approx. 25 K ohms                           | 1000 ohms                                   |
| Reference Carrier Winding Input Impedance                                                                                                       | 10 K ohms                                   | 20 K ohms                                   | 10 K ohms                                   | 5 K ohms                                    |
| External Load for Zero Phase Shift of Output versus Reference                                                                                   | 50 K to 250 K ohms                          | 50 K to 350 K ohms                          | 50 to 350 K ohms                            | Approx. 100 K ohms                          |
| Null or Zero Drift over Temperature Range of $-55^\circ\text{C}$ to $+125^\circ\text{C}$ in Terms of DC Input Sig. Reference to Input Terminals | $\pm 0.5 \mu\text{A}$ DC Maximum            | $\pm 0.3 \mu\text{A}$ DC Maximum            | $\pm 0.1 \text{ mV}$ DC Maximum             | $\pm 0.25 \mu\text{A}$ DC Maximum           |
| Hysteresis in Percent of Maximum Input DC Signal                                                                                                | 0.25% Maximum                               | 0.25% Maximum                               | 0.25% Maximum                               | 0.25% Maximum                               |
| Percent Harmonic Distortion in Output Product Wave                                                                                              | Approx. 15%                                 | Approx. 20%                                 | Approx. 20%                                 | Approx. 15%                                 |
| Overall Dimensions (in Inches)                                                                                                                  | $1 \times 1\frac{1}{8} \times 1\frac{3}{4}$ | $1 \times 1\frac{1}{8} \times 1\frac{3}{4}$ | $1 \times 1\frac{1}{8} \times 1\frac{3}{4}$ | $1\frac{1}{8} \times 1\frac{1}{8} \times 2$ |
| Type of Mounting                                                                                                                                | Two 4-40 Studs                              | Two 4-40 Studs                              | Two 4-40 Studs                              | Two 4-40 Studs                              |
| Approximate Weight (in Ounces)                                                                                                                  | 4                                           | 4                                           | 4                                           | 5                                           |

"Mag Mods"® are products of —

**GENERAL  
MAGNETICS  
INC**

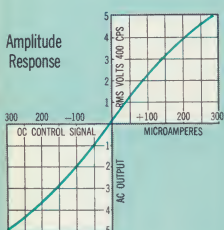
135 BLOOMFIELD AVENUE  
BLOOMFIELD, NEW JERSEY



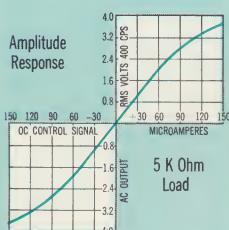




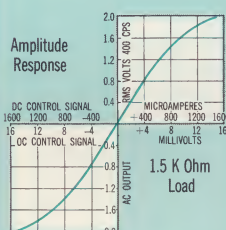
**Standard Magnetic Modulator  
Type IMM-366-3**



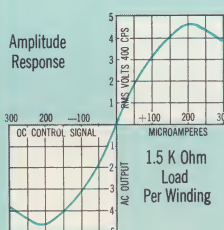
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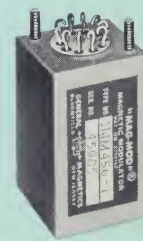
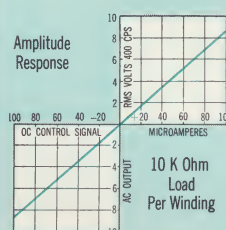
**Standard Magnetic Modulator  
Type MTC-343-10**



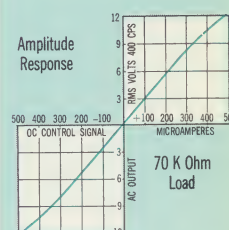
**Standard Magnetic Modulator  
Type IMM-400-1**



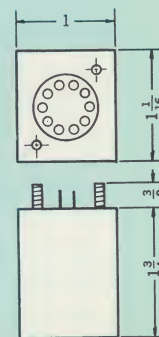
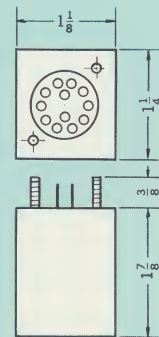
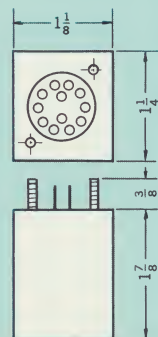
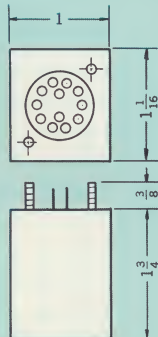
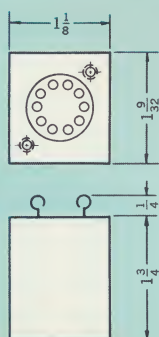
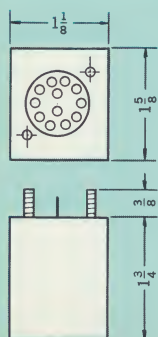
**Standard Magnetic Modulator  
Type IMM-421-1**



**Standard Magnetic Modulator  
Type IMM-456-1**



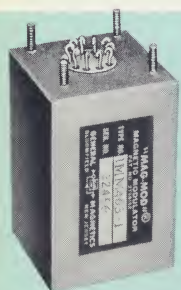
| IMM-366-3                                                  | IMM-371-3                                                                              | MTC-343-10                                  | IMM-400-1                                              | IMM-421-1                                              | IMM-456-1                                   |
|------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|---------------------------------------------|
| 115 V @ 400 cps                                            | 115 V @ 400 cps                                                                        | 115 V @ 400 cps                             | 115 V @ 400 cps                                        | 115 V @ 400 cps                                        | 115 V @ 400 cps                             |
| 3 DC Signal Windings<br>0 to $\pm 300 \mu\text{A}$ DC each | In. Wdg. 1, 0 to $\pm 150 \mu\text{A}$ DC<br>In. Wdg. 2, 0 to $\pm 600 \mu\text{A}$ DC | 0 to $\pm 15 \text{ mv}$ DC                 | 0 to $\pm 300 \mu\text{A}$ DC                          | 2 Windings<br>0 to $\pm 100 \mu\text{A}$ DC each       | 0 to $\pm 500 \mu\text{A}$ DC               |
| 3 Windings<br>Approx. 3500 ohms each                       | In. Wdg. 1, 9 K ohms<br>In. Wdg. 2, 1900 ohms                                          | 10 ohms                                     | 9740 ohms                                              | 2 Windings<br>10 K ohms each                           | 500 ohms                                    |
| 0 to 5.0 V RMS<br>@ 400 cps                                | 0 to 3.6 V RMS<br>@ 400 cps                                                            | 0 to 2.0 V RMS<br>@ 400 cps                 | 2 Out. Windings each<br>0 to 4.5 V RMS @ 400 cps       | 0 to 8.7 V RMS @ 400 cps<br>(Output Center Tapped)     | 0 to 12 V RMS<br>@ 400 cps                  |
| 23 mv/ $\mu\text{A}$<br>(Across 1 K ohm Load)              | 30 mv/ $\mu\text{A}$ DC<br>(Using Sig. Wdg. 1)                                         | 100 mv/ $\mu\text{A}$                       | 2 Output Windings<br>30 mv/ $\mu\text{A}$ each         | 100 mv/ $\mu\text{A}$<br>(Each Signal Winding)         | 30 mv/ $\mu\text{A}$                        |
| 30 mv RMS                                                  | 15 mv RMS Maximum                                                                      | 10 mv RMS Maximum                           | 10 mv RMS Maximum                                      | 25 mv RMS Maximum                                      | 50 mv RMS Maximum                           |
| 500 to 1000 ohms                                           | 500 to 800 ohms                                                                        | 1000 to 2 K ohms                            | 500 to 1000 ohms                                       | 10 K ohms, each side of CT                             | 16 K ohms                                   |
| 50 K ohms                                                  | 100 K ohms                                                                             | 25 K ohms                                   | 10 K ohms                                              | 20 K ohms                                              | 20 K ohms                                   |
| 1000 ohms                                                  | 5 K ohms                                                                               | 1500 ohms                                   | 1500 ohms<br>(On each Winding)                         | 10K — CT — 10K<br>ohms                                 | 70 K to 100 K ohms                          |
| $\pm 1.0 \mu\text{A}$ DC Maximum                           | $\pm 0.5 \mu\text{A}$ DC Maximum                                                       | $\pm 0.05 \text{ mv}$ Maximum               | $\pm 0.5 \mu\text{A}$ DC Maximum                       | $\pm 0.5 \mu\text{A}$ DC Maximum                       | $\pm 1.0 \mu\text{A}$ DC Maximum            |
| 0.3% Maximum                                               | 0.25% Maximum                                                                          | 0.3% Maximum                                | 0.25% Maximum                                          | $\pm 0.5\%$ Maximum                                    | $\pm 0.25\%$ Maximum                        |
| Approx. 20%                                                | Approx. 30%                                                                            | Approx. 25%                                 | Approx. 25%                                            | Approx. 30%                                            | Approx. 20%                                 |
| $1\frac{1}{8} \times 1\frac{1}{8} \times 1\frac{1}{4}$     | $1\frac{1}{8} \times 1\frac{1}{8} \times 1\frac{1}{4}$                                 | $1 \times 1\frac{1}{8} \times 1\frac{1}{4}$ | $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{1}{8}$ | $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{1}{8}$ | $1 \times 1\frac{1}{8} \times 1\frac{1}{4}$ |
| Four 4-40 Studs                                            | Two 4-40 Studs                                                                         | Two 4-40 Studs                              | Two 4-40 Studs                                         | Two 4-40 Studs                                         | Two 4-40 Studs                              |
| 6                                                          | 4.5                                                                                    | 4                                           | 5                                                      | 5                                                      | 4                                           |





# MODS" CONFORM TO MIL-T-27A AND MIL-E-5400 SPECIFICATIONS

Products shown approximately one-half actual size



Standard Magnetic Modulator  
Type IMM-463-1



Standard Magnetic Modulator  
Type IMM-415-1



Standard Magnetic Modulator  
Type IMM-625-1



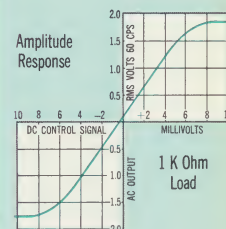
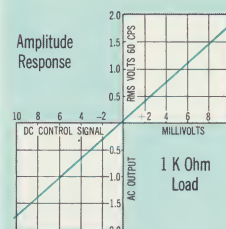
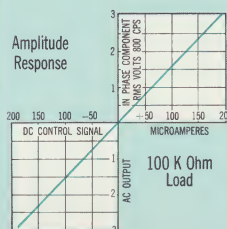
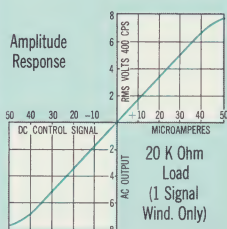
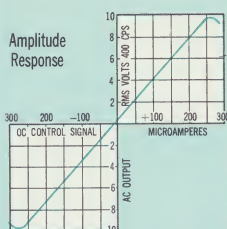
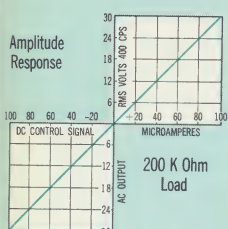
Standard Magnetic Modulator  
Type IMM-629-5



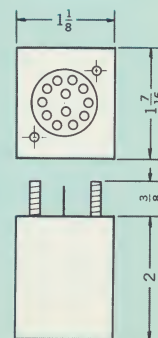
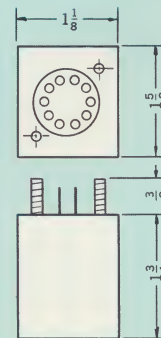
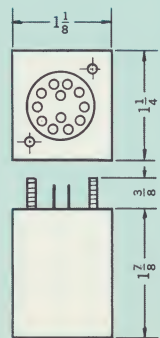
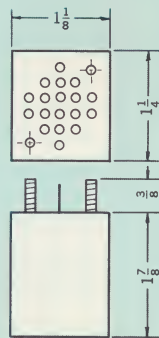
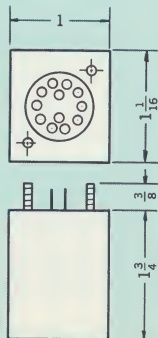
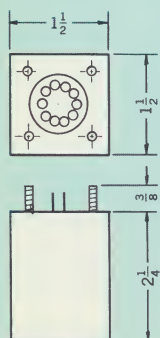
Standard Magnetic Modulator  
Type MTC-630-1



Standard Magnetic Modulator  
Type MTC-631-2



| IMM-463-1                                              | IMM-415-1                                   | IMM-625-1                                                                     | IMM-629-5                                                                    | MTC-630-1                                              | MTC-631-2                                   |
|--------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------|
| 115 V @ 400 cps                                        | 6 V @ 400 cps                               | 115 V @ 400 cps                                                               | 115 V @ 800 cps                                                              | 6.3 V @ 60 cps                                         | 6.3 V @ 60 cps                              |
| 0 to $\pm 100 \mu\text{A}$ DC                          | 0 to $\pm 300 \mu\text{A}$ DC               | 4 Windings<br>0 to $\pm 50 \mu\text{A}$ DC each                               | 2 Windings<br>0 to $\pm 200 \mu\text{A}$ DC each                             | 0 to $\pm 10$ mv DC                                    | 0 to 10 mv DC                               |
| 10 K ohms                                              | 1000 ohms                                   | 4 Windings<br>Approx. 33 K ohms each                                          | 2 Windings<br>200 ohms each                                                  | 136 ohms                                               | 7 ohms                                      |
| 0 to 30 V RMS<br>@ 400 cps                             | 0 to 9.0 V RMS<br>@ 400 cps                 | 0 to 8.0 V RMS<br>@ 400 cps                                                   | 0 to 3.0 V RMS<br>@ 800 cps                                                  | 0 to 1.5 V RMS<br>@ 60 cps                             | 0 to 1.5 V RMS<br>@ 60 cps                  |
| 300 mv/ $\mu\text{A}$                                  | 40 mv/ $\mu\text{A}$                        | 200 mv/ $\mu\text{A}$ (Each Winding)<br>800 mv/ $\mu\text{A}$ (All in Series) | 15 mv/ $\mu\text{A}$ (Each Winding)<br>30 mv/ $\mu\text{A}$ (Both in Series) | 175 mv/ $\mu\text{A}$                                  | 175 mv/ $\mu\text{A}$                       |
| 100 mv RMS Maximum                                     | 20 mv RMS Maximum                           | 30 mv RMS Maximum                                                             | 20 mv RMS Maximum                                                            | 10 mv RMS Maximum                                      | 10 mv RMS Maximum                           |
| 50 K ohms                                              | 14 K ohms                                   | 67 K ohms                                                                     | 73 K ohms                                                                    | 2 K ohms                                               | 2 K ohms                                    |
| 20 K ohms                                              | 5 K ohms                                    | 15 K ohms                                                                     | 20 K ohms                                                                    | 5 K ohms                                               | 9 K ohms                                    |
| 200 K to 500 K ohms                                    | 10K — CT — 10K<br>ohms                      | 20 K ohm Output AC<br>Lags Ref. Carrier by 30°                                | 100 K to 200 K ohms                                                          | 1000 ohms                                              | 500 — CT — 500<br>ohms                      |
| $\pm 0.5 \mu\text{A}$ DC Maximum                       | $\pm 0.5 \mu\text{A}$ DC Maximum            | $\pm 0.2 \mu\text{A}$ DC Maximum                                              | $\pm 1.0 \mu\text{A}$ Referred to<br>One Signal Wdg. Input                   | $\pm 0.05$ mv DC Maximum                               | $\pm 0.05$ mv DC Maximum                    |
| $\pm 0.5\%$ Maximum                                    | $\pm 0.25\%$ Maximum                        | $\pm 0.2\%$ Maximum                                                           | 0.5% Maximum                                                                 | 0.3% Maximum                                           | 0.3% Maximum                                |
| Approx. 15%                                            | Approx. 15%                                 | Approx. 30%                                                                   | Approx. 2%                                                                   | Approx. 10%                                            | Approx. 10%                                 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times 2\frac{1}{4}$ | $1 \times 1\frac{1}{8} \times 1\frac{3}{4}$ | $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{7}{8}$                        | $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{7}{8}$                       | $1\frac{1}{8} \times 1\frac{1}{8} \times 1\frac{3}{4}$ | $1\frac{1}{8} \times 1\frac{1}{8} \times 2$ |
| Four 4-40 Studs                                        | Two 4-40 Studs                              | Two 4-40 Studs                                                                | Two 4-40 Studs                                                               | Two 4-40 Studs                                         | Two 4-40 Studs                              |
| 7                                                      | 4                                           | 4.5                                                                           | 4.5                                                                          | 5                                                      | 6                                           |

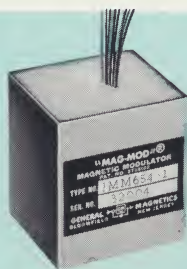




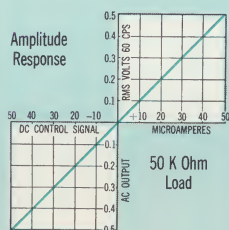
## ELECTRICAL AND MECHANICAL ADVANTAGES—

The "MAG MOD" Magnetic Modulator is a DC to AC Converter which presents a linear relationship between input control signal and output AC. It is a device whose output is a function of one variable. A variable amplitude bipolar DC, or low frequency AC, applied to the input produces a corresponding variable amplitude phase reversing AC output of 0° or 180° with respect to the reference carrier, depending on the magnitude and polarity of the input signal.

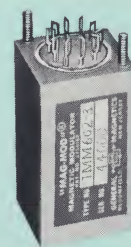
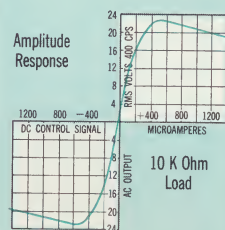
The magnetic modulator may easily be designed to operate



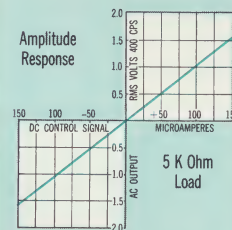
**Standard Magnetic Modulator  
Type IMM-654-1**



**Standard Magnetic Modulator  
Type IMM-537-1**

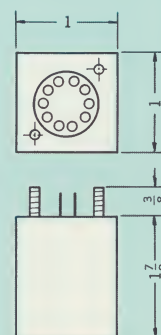
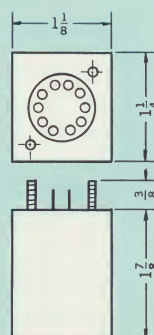
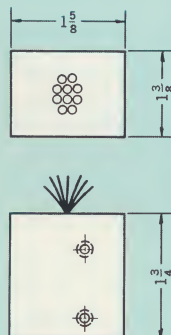


**Standard Magnetic Modulator  
Type IMM-602-3**



| TYPE NUMBER                                                                                                                                     | IMM-654-1                                              | IMM-537-1                                              | IMM-602-3                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|----------------------------------|
| Reference Carrier Voltage and Frequency                                                                                                         | 115 V @ 60 cps                                         | 115V @ 400 cps                                         | 115V @ 400 cps                   |
| Input Control Signal Range                                                                                                                      | 0 to $\pm 50 \mu\text{a}$ DC                           | 0 to $\pm 400 \mu\text{a}$ DC                          | 0 to $\pm 150 \mu\text{a}$ DC    |
| DC Resistance of Input DC Signal Winding                                                                                                        | 2 K ohms                                               | 18 K ohms for 2 Signal Windings in Series              | 1250 ohms                        |
| AM Phase Reversing AC Output Range                                                                                                              | 0 to 0.6 V RMS @ 60 cps                                | 0 to 22 V RMS @ 400 cps                                | 0 to 1.5 V RMS @ 400 cps         |
| Differential Gain RMS Volts AC Output/ $\mu\text{a}$ DC Signal Input                                                                            | 12 mv/ $\mu\text{a}$                                   | 125 mv/ $\mu\text{a}$                                  | 11 mv/ $\mu\text{a}$             |
| AC Output Null (Noise Level) mv RMS                                                                                                             | 5 mv RMS Maximum                                       | 100 mv RMS Maximum                                     | 5 mv RMS Maximum                 |
| Output Impedance                                                                                                                                | 22 K ohms                                              | 43 K ohms                                              | 1650 ohms                        |
| Reference Carrier Winding Input Impedance                                                                                                       | 20 K ohms                                              | 20 K ohms                                              | 32 K ohms                        |
| External Load for Zero Phase Shift of Output versus Reference                                                                                   | 50 K ohms                                              | 10 K ohms                                              | 5 K ohms                         |
| Null or Zero Drift over Temperature Range of $-55^\circ\text{C}$ to $+125^\circ\text{C}$ in Terms of DC Input Sig. Reference to Input Terminals | $\pm 0.1 \mu\text{a}$ DC Maximum                       | $\pm 1.0 \mu\text{a}$ DC Maximum                       | $\pm 0.5 \mu\text{a}$ DC         |
| Hysteresis in Percent of Maximum Input DC Signal                                                                                                | $\pm 0.2\%$ Maximum                                    | $\pm 0.1\%$ Maximum                                    | $\pm 0.25\%$ Maximum             |
| Percent Harmonic Distortion in Output Product Wave                                                                                              | 15% Maximum                                            | —                                                      | 5% Maximum                       |
| Overall Dimensions (in Inches)                                                                                                                  | $1\frac{1}{8} \times 1\frac{5}{8} \times 1\frac{1}{4}$ | $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{1}{8}$ | $1 \times 1 \times 1\frac{1}{4}$ |
| Type of Mounting                                                                                                                                | Two 4-40 Studs                                         | Two 4-40 Studs                                         | Two 4-40 Studs                   |
| Approximate Weight (in Ounces)                                                                                                                  | 5                                                      | 5                                                      | 4                                |

over any energy or input/output impedance level. Any number of inputs and/or outputs may be provided depending upon the analog operation requirements. Addition, subtraction, multiplication, raising to a power and conversion are but a few of the countless circuit functions within the capability of this device.



REFER TO BACK PAGE FOR BULLETINS ON OTHER "MAG MOD" MAGNETIC MODULATORS AND HIGH STABILITY OSCILLATORS



# "MAG MOD"

## MAGNETIC MODULATORS

General Magnetics  
maintains extensive  
laboratory facilities  
for research  
and development



The Engineering  
Department is  
prepared to  
customize designs  
for special  
requirements.



All phases  
of production are  
carefully controlled  
to insure strict  
adherence to  
quality standards



The "MAG MOD" has proven to be the most reliable module circuit block in aircraft and space vehicle flight control systems developed to date. Its ruggedness, dependability, repeatability, universal energy and impedance ranges and superior performance have resulted in its use in many military and commercial products where reliability is a prime factor.

Typical of the applications where the "MAG MOD" is utilized are missile, satellite and aircraft control and position circuits, fire control and bombing computers, analog circuit functions, antenna position data conversion, and an infinite variety of conversion, computing and modulation operations.

**Custom Requirements** — Customized application engineering, whenever required, will be performed on a no charge basis.

**Bulletins Available** — on "MAG MOD" components include Micro-circuit Magnetic Modulators Bulletin MM 101, Miniaturized Magnetic Modulators Bulletin MM 102, Miniaturized Multiplying Modulators Bulletin MM 104, and Miniaturized High-stability Oscillators Bulletin MM 105.



**GENERAL  
MAGNETICS • INC**

135 BLOOMFIELD AVENUE, BLOOMFIELD, NEW JERSEY

THERE IS NO SUBSTITUTE FOR RELIABILITY